

Sediment Dispersal from the Apennine Rivers

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LONG-TERM GOALS

The most general long-term goals of this study, as part of EuroSTRATAFORM, are to investigate the oceanic processes that erode, transport, and deposit sediment in the margin system. More specifically, this project seeks to define and describe the Western Adriatic Current and the Po and Apennine River plumes by direct observations, as well as specially focused experiments to document aspects of dispersal that lead to event layers, bed reworking and cross-margin sediment flux.

OBJECTIVES

The focus of this project is on four main objectives:

1. to document coastal current structure and related sediment transport.

The Western Adriatic Current (WAC) is important for far-field dispersal of Po River sediment. Because the Po experiences high discharge events in winter, coinciding with the high energy of the Bora winds, resuspension of recently deposited sediment and alongshelf advection by the WAC may be a significant source of sediment to the Apennine margin. Documenting ambient conditions (buoyancy, sediment concentrations, and velocity structure) is important for evaluating the relative contribution of the Po to the western Adriatic margin.

2. to document spatial structure of wave resuspension.

The time-series measurements made by boundary layer tripods are critical for evaluating the role of wave resuspension and transport, and often record episodic transport that would be difficult, if not impossible, to capture with shipboard measurements. However, these observations are limited by spatial specificity and provide only limited information about the overlying water column. The water column information is partially addressed by including moorings, but the spatial limitation remains. The combination of water column measurements from the sea surface to the seabed, both across-shelf and along-shelf, defines the spatial gradients and provides important information on how widely the time series measurements can be applied.

3. to document delivery of sediment associated with run-off events.

4. to document cross-margin transport and emplacement of sediment.

Apennine Rivers are flashy, with potentially high concentrations of suspended sediment that gets delivered to the inner shelf and transported to foreset region. Water column measurements that extend from the river source to the foresets, especially around the time of an event, would be extremely useful in determining how sediments are emplaced. If an event is documented, this would be of great value to models to set realistic thresholds of sediment concentration and thickness of the suspension.

APPROACH

To understand the mechanisms of sediment dispersal once delivered to the marine environment, a combination of water column (surface to very near bottom) and bottom boundary layer time-series measurements are necessary. As part of the overall objectives of EuroSTRATAFORM, the work outlined here is one part of a greater whole. The role of this proposal is to address the objectives described above by focusing on water-column observations. The area of interest encompasses the coastal current, the inner shelf influenced by the input from the Po and Apennine Rivers, and the water column overlying the region of sediment accumulation. The necessary observations include measurements of currents, buoyancy (salinity and temperature), and suspended sediments (which also influence buoyancy). The current measurements will be acquired using a ship-mounted ADCP. The buoyancy and suspended sediment measurements will be made using an instrumented profiling tripod (Sternberg et al. 1991).

The sampling plan for the water-column component will be to perform regional surveys extending from the Po River to the Gargano Promontory, with emphasis on the rivers between Ancona and Pescara (Figs. 1,2). The regional survey will consist of transects with ADCP and profiling for salinity, temperature and suspended sediments. Transects will extend from 8 m water depth through the coastal current to depths of ~45 m. Stations will be approximately every 2 km in the across shelf direction, but spacing will vary to maximize definition of gradients.

While water column surveys will be carried out during each deployment and recovery cruise for moorings and tripods (UW, USGS, and WHOI participants), the intensive water column surveys that are the focus of this work will be done in February to maximize chances of capturing discharge events from the Apennine Rivers. If suspended-sediment concentrations in the rivers are as high as the denudation and discharge rates imply, it is quite possible a high-concentration bottom layer may form and result in a hyperpycnal flow, in which case we hope to be able to observe this with the profiling tripod.

WORK COMPLETED

Experimental work for this project has not yet begun. Two planning meetings, one in Seattle (June 2002) and one in Winchester, UK (September 2002) have brought EuroSTRATAFORM scientists together to develop unified sampling plans.

RESULTS

Preliminary observations from April 2002 by Ogston (UW), Nittrouer (UW) and Wheatcroft (OSU) off the Po River and the Apennine margin suggest the Apennine rivers may not be a major source of modern sediment to the shelf. Therefore, we are adjusting our sampling plan to focus on the entire

dispersal system, from the Po to the Gargano Promontory with added effort on determining the relative contribution of sediment from the Po.

IMPACT/APPLICATIONS

Focusing effort on water column measurements provides spatial information to link tripod time-series measurements, provides ground-truthing to satellite and shipboard optical measurements of turbidity, and a means of relating nearbed, bottom boundary layer processes to the overlying water column. The sum of these observations provides the means to assess mechanisms for sediment dispersal and formation of strata.

TRANSITIONS

See Related Projects below.

RELATED PROJECTS

The water column work described here is an integral part of the Sediment Transport and Strata Formation work proposed by Geyer, Traykovski and Lynch (WHOI). In addition, there will be close collaboration with the proposed work of Ogston and Sternberg (UW). They will be carrying out large-scale water column surveys, as well as surveys during deployment, turnaround, and recovery of tripods. We have a long history of collaboration and sharing instrumentation and we intend to continue that through Eurostrataform.

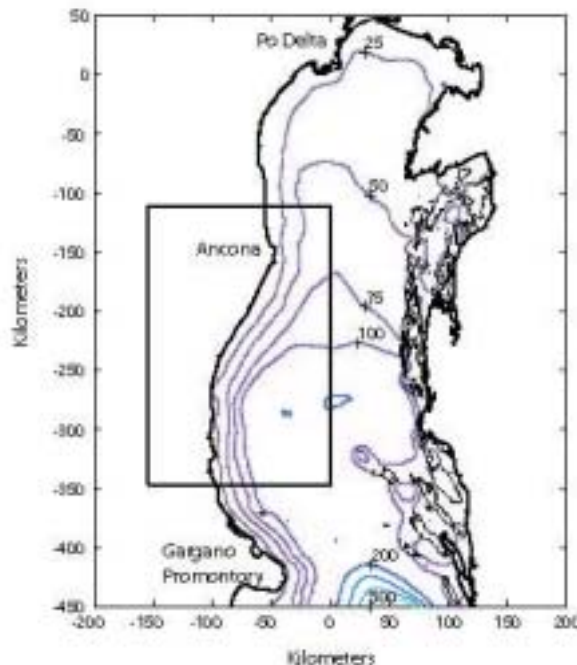


Figure 1. Map of the Northern Adriatic. Contours are in meters.

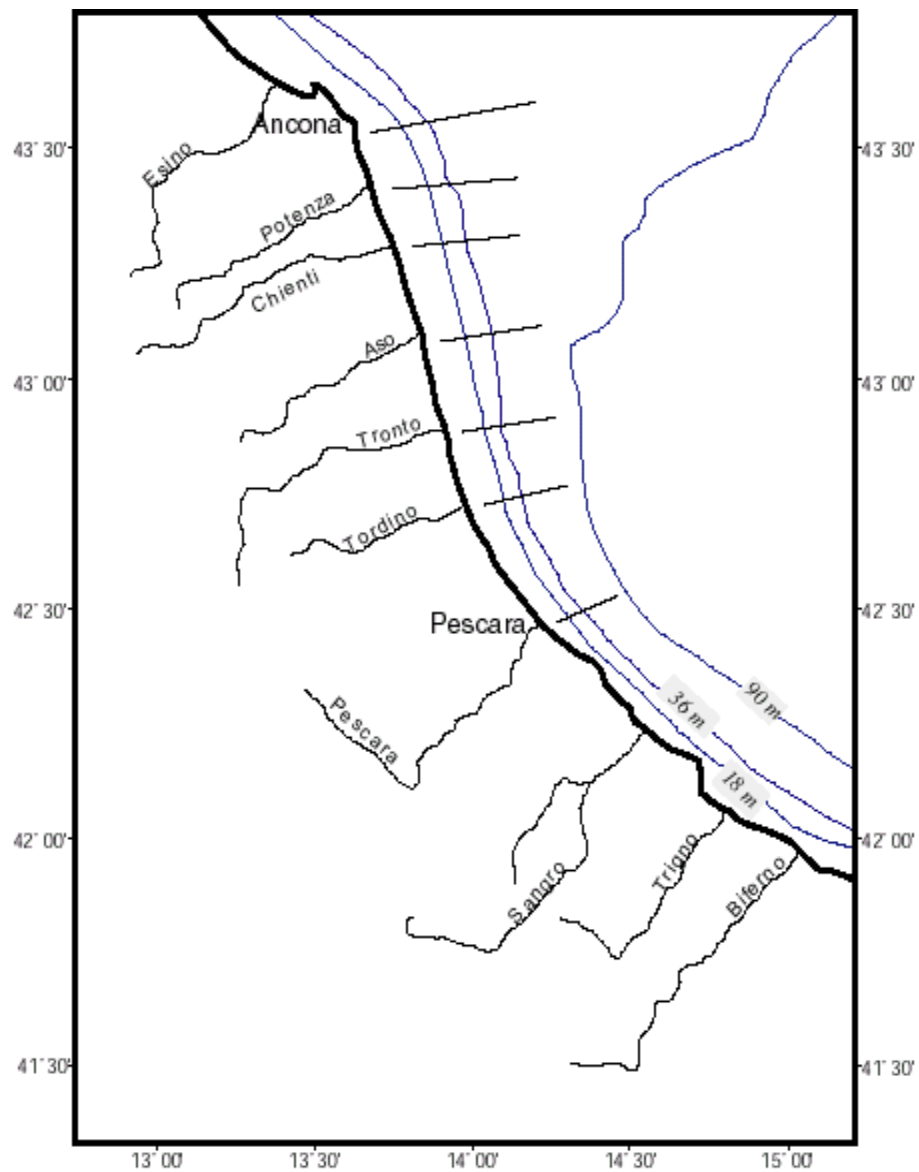


Figure 2. Rivers of the Apennine margin with proposed sampling transects.

Sediment Trapping and Transport in Estuaries, Southeastern US, National Science Foundation CAREER Development Program, Kineke PI. This project began in September 1997 and is investigating sediment transport and trapping mechanisms in three estuaries in the southeastern United States.

REFERENCES

Sternberg, R. W., G. C. Kineke and R. Johnson, 1991. An instrument system for profiling suspended sediment, fluid and flow conditions in shallow marine environments. *Continental Shelf Research*, **11**:109-122.

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